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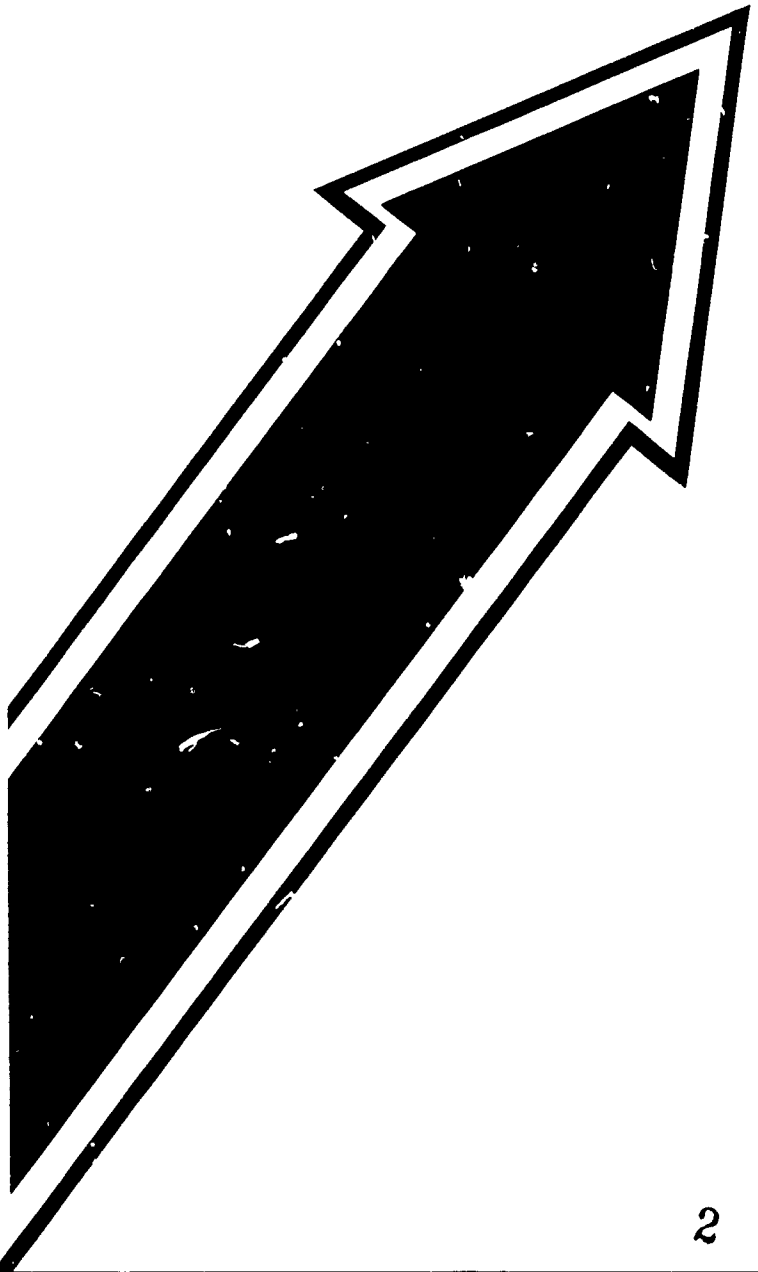
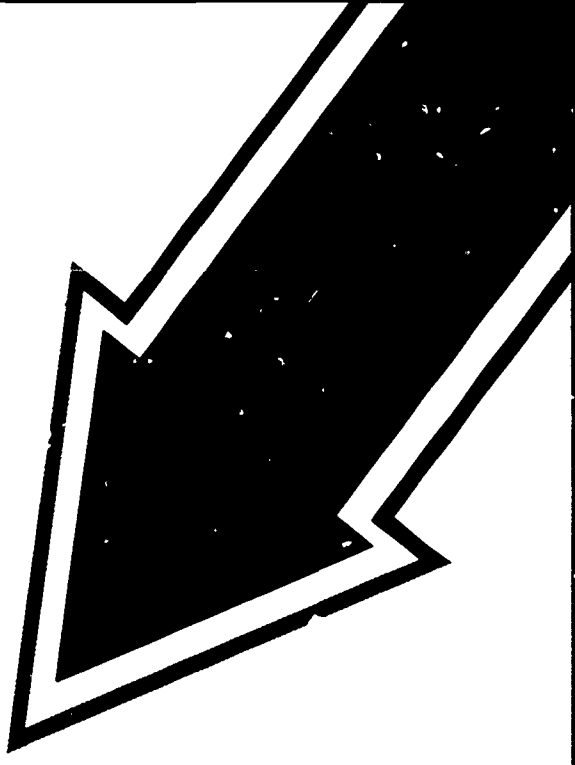
ABSTRACT

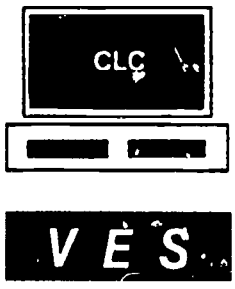
Presented in nontechnical language, this guide suggests criteria for the selection of three computer hardware essentials--a microcomputer, a monitor, and a printer. Factors to be considered in selecting the microcomputer are identified and discussed, including what the computer is to be used for, dealer support, software availability, modem access, add-on capability, the manufacturer, competing brands, and the speed, memory, and power capabilities of the central-processing unit. Key elements to consider when choosing a monitor, which is also called a cathode-ray-tube (crt) display unit, are also explained, including number of screen pixels, number of characters per screen, maximum number of colors, bandwidth, dot pitch, convergence, phosphor persistence, and provisions for prevention of glare from the screen. Various features of the major types of printers--dot matrix, daisy wheel, thimble, thermal, ink jet, and laser--are also discussed, including quality of characters, print pitch, proportional spacing, carriage width, speed, buffer, support, and cost. The importance of defining what the computer is be used for is emphasized, and the rapidity of new technological developments is noted. A glossary of computer terms is included as well as a list of 15 journal articles for further reading. (RP)

Hardware Selection: A Nontechnical Approach

Sebastian F. Kiteka







HARDWARE SELECTION: A NONTECHNICAL APPROACH

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What You Will Read About

What technical components of a computer should a potential buyer know about?

What is add-on capability?

What is the difference between an 8088- and an 80286-based PC?

Are some monitors more readable than others?

What is the difference between printers?

Is an expensive printer worth the cost?

Key Terms

A glossary is at the end of the article. Following are terms that you will become familiar with:

- add-on capability
- AT
- bandwidth
- convergence
- DOS
- EGA
- letter quality
- MHz
- modem
- pixel
- port
- RAM

HARDWARE SELECTION: A NONTECHNICAL APPROACH

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Computer technology today is like a shooting star. Products burst on and vanish from the marketplace before we know it. In light of the pace of change, I can only hope that the following hints about how to select hardware essentials--a microcomputer, a monitor, and a printer --will not be obsolete before you finish reading them.

Computer Selection

It isn't necessary to understand exactly how a microcomputer works in order to buy one. But if you know a few things about a microcomputer's technical components, you will be able to make a more informed decision. Many people choose a particular microcomputer because they know someone who uses it or because they have heard that it can do what they want. These criteria are important, but other factors should also be considered.

Make a Wish List. First, decide why you want a microcomputer. Don't say simply that you need one for unidentified or ambiguous "home use" reasons. Instead, spell out what your needs are. While microcomputers can do almost anything, except actions requiring intuition or emotion, none of them comes equipped with every feature you may need. For instance, while it may not be necessary to buy additional hardware for simple word processors, many of them require extra memory, which is another expense. Other microcomputers need additional,

and costly, hardware for color or graphics. Defining your needs in specific terms will help you identify any additional purchases you may have to make.

With your wish list in hand, make sure that the microcomputers that you are interested in can do what you want. If necessary, find out which "add-ons," or extra features, you will need. There are inexpensive microcomputer systems on the market, but their standard equipment may be inadequate for your needs. For example, some microcomputers do not come with a disk operating system (DOS), the program that enables a microcomputer system to access disk drives and other peripheral devices; DOS must then be purchased separately. In addition, if you want a microcomputer that is compatible with another brand, check to see that the operating system is the same or similar to the brand you want to match. Other important factors are

- dealer support
- software
- modem access
- add-on capability
- manufacturer
- competitors
- 8088 PC or 80286 AT

Dealer Support. Computers consist of electronic and mechanical components, and while the electronic components are not likely to malfunction, the mechanical components may. To save time and energy, find a local dealer who can solve your microcomputer problems when they arise. If local support is unavailable, keep all receipts for

both warranty and identification purposes and store the original packing boxes. If you must mail your microcomputer to a repair center, pack it well. Otherwise, you may lose the warranty protection.

Software. Before buying a microcomputer, find out what software is available for it. Beware of low microcomputer prices: You may end up owning a machine for which there is very little software. This situation is especially true with new microcomputers on the market. For example, the Xenix operating system is very user friendly, but the computers built around it have less software than those designed for the MS or IBM DOS operating systems.

It is important to note that software produced by independent software developers is designed for the IBM PC and, as a result, may not run on compatibles. A machine that offers inadequate software is no bargain. These comments are not an endorsement of any particular microcomputer; they are made simply to illustrate the problems associated with hardware compatibility.

To run major IBM software on an IBM PC clone, a microcomputer designed to work like an IBM, you can buy Phoenix BIOS. BIOS stands for basic input-output system. BIOS handles input and output activities involving reading and writing to disk drives and accessing other peripherals. (See your DOS technical manual for more information about BIOS.) There are other programs like Phoenix BIOS, but it has the best reputation for making clones truly compatible to the IBM PC. Major IBM clone producers such as AT&T use Phoenix BIOS.

Modem Access. If telecommunications capability is on your wish list, there is another microcomputer feature that you should look for.

The microcomputer you choose should come with a communications port for a modem or you will need to purchase additional hardware.

Add-on Capability. The microcomputer industry changes so fast that the microcomputer you buy today may seem like an antique next month. Ask your dealer whether devices can be added to the microcomputer you're considering so that it can be kept up to date. Some microcomputers are built in such a way that you cannot add on extra devices, and you may regret your selection.

Manufacturer. Another consideration is the longevity of the computer manufacturer. Is the company likely to stay in business? More than a few microcomputer buyers have saved money by getting a lesser-known brand of microcomputer, only to find out several months later that the company has closed. Be careful. Unless you can trouble-shoot computer problems, you should not buy a machine from a lesser-known maker. You may end up with a microcomputer that no one can repair or find parts for. On the other hand, some companies have promising futures and offer computers as good as or better than well-known, and more expensive, models.

Competitors. If you are interested in buying a lesser-known brand of microcomputer, you may want to compare its price with IBM, Compaq, Leading Edge, and other well-known systems. The IBM PC, for example, costs considerably more than the Leading Edge Model D. The IBM charges an extra $50 for DOS and more for the printer interface, the communication interface, and color. The Leading Edge, on the other hand, comes with most of these features and includes an internal clock

and calendar. It also costs no more than $75 to increase the Leading Edge internal memory to 640K, and no slots are required to do so.

But, again, consider how long the companies are likely to be in business. IBM is one of the best-managed companies in the world, and you can be fairly confident about future support if you buy an IBM machine; you cannot be as certain about the future of Leading Edge.

8088 PC or 80286 AT? One of the biggest questions today is whether to buy an 8088- or an 80286-based microcomputer. A regular microcomputer (PC) has an 8088 central-processing unit (cpu), the brain of the computer, with a clock speed of 4.77 megahertz (MHz), or 4.77 million cycles per second. In comparison, an advanced-technology (AT) 80286 cpu has a clock speed of 6MHz to 12MHz. Another issue is whether to simply upgrade a PC to an AT by buying a speed-upgrade card.

Desktop publishing, perhaps the hottest application for the next few years, requires a large amount of random-access memory (RAM) and a higher clock speed than 4.77MHz. In addition, new add-ons require more electrical power consumption than PCs provide. AT machines have a power supplier of 200 watts or more, which is ready for add-ons. In comparison, the 8088 PCs have a power supply of 135 watts.

It is important to note that, in spite of the popularity of machines running up to 12MHz, most software is designed for a regular PC with a clock speed of 4.77MHz. This means that while electronic spread sheets, data bases, and other speed-hungry applications work well on the AT models, programs designed for slow speed may not work

properly. For instance, some graphics programs such as games and simulations must either be modified or the AT speed must be reduced.

Considering these factors, the best choice may be an AT-type machine with a selectable clock speed of 6MHz to 12MHz. These speeds ensure that 8088-based software will run and the next generation of high-speed software also will work. Another advantage of ATs is that, when the appropriate DOS is available, they will be able to access more RAM than regular PCs, which are limited to 640K.

The 80386, the next generation after the 80286, entered the market in 1986. But, like its predecessor, its price tag and current software have not made it a "hit" in either the home or school market. This situation, however, won't last.

Monitor Selection

The monitor, sometimes referred to as a cathode-ray-tube (crt) display unit, is one of the microcomputer devices that new users most often overlook. It is the means by which the user communicates with the microcomputer: The user must be able to read what he or she types into the microcomputer as well as the machine's responses. For this reason, it is important to know something about monitors before you buy a computer system. Key elements to consider when choosing a monitor are the

- number of screen pixels
- number of characters per screen
- maximum number of colors
- bandwidth

- dot pitch
- convergence
- phosphor persistence

Screen Pixels. The screen pixel is the most common unit for measuring monitor resolution, or clarity. It is usually defined as the number of pixels that can be displayed horizontally divided by the number displayed vertically. Monitor specification pamphlets list the number of screen pixels as 800 x 700 or 800V x 700H, for example. These numbers mean that the monitor is capable of displaying 800 pixels vertically and 700 pixels horizontally.

Each character is formed by lighted pixels, so the higher the number of pixels the better the character image. Some manufacturers may not include a pixel specification if their product does not have very good resolution. If this is the case with a monitor you are considering, try it out before you buy it or you may be disappointed. Do not, however, choose a monitor based solely on the number of screen pixels. Other factors affect screen display, too.

Characters per Screen. The most common monitor specifications are 1920, 2000, etc. The number 1920 means that the monitor is capable of displaying 24 lines of 80 characters each. The standard for word processing is 80 characters per line; it is difficult to read a screen that has fewer characters per line.

As with screen pixels, the more characters per screen the better. Some monitors display more than 25 lines and more than 80 characters per line; these monitors are quite expensive. A monitor that displays 24 lines of 80 characters each is all you need for word processing.

For desktop publishing, you may want a screen capable of displaying 66 lines, a full page. These screens usually are rated well above 1000V x 800H and cost considerably more than smaller screens.

Maximum Number of Colors. Monitors come in a variety of color combinations. A monochrome monitor produces a single color, such as green, amber, or white.

For word-processing, many people think that an amber monitor causes less eye strain than a green one. Some countries have even recommended amber screens for people who work with microcomputers daily.

White-background monitors with black letters also seem to cause less eye strain. This, perhaps, is because we are used to reading books and other black-on-white materials. It is also believed that eye strain may be caused when we read text on paper and then look at a colored screen. There is less difference between the paper format and a white screen.

There is no research showing the evidence of any color causing less eye strain than another. But nonscientific surveys have indicated that many microcomputer users prefer amber to green, and prefer white to amber or green. There is, however, a huge stock of green monitors, and that may determine why manufacturers offer few options.

Color Monitors. Color monitors come in two types: composite and red, green, and blue (RGB). Composite monitors are the most common and the cheapest. Be careful when purchasing a color monitor, however. If your primary need is word processing, a composite color monitor may not be appropriate. While its 40-character-per-line for

mat displays readable characters, the 80-column format is hard to read.

If you need both word-processing and graphics capability, consider purchasing a RGB monitor, which can display readable characters in an 80-character-per-line format. But before making a decision, try it out to see the text quality. All RGB monitors are not equal.

RGB monitors are capable of displaying 16 or more colors. That may sound like a great feature, but before you buy one make sure your microcomputer can take advantage of it. RGB monitors are more expensive than composite monitors but, like microcomputers, they are becoming cheaper. A monitor that cost $1000 a few years ago costs less than $500 today.

When selecting a monitor, make sure that your microcomputer can communicate with it. If the monitor has features that your microcomputer can't handle, you are wasting your money. In addition, your software must be able to work with the monitor's special features.

Bandwidth. Bandwidth is the speed at which a monitor can accept data from the microcomputer. It is measured in megahertz and plays a crucial role in the monitor's performance. Bandwidth determines the screen's refresh rate (speed at which pixels are reactivated so they stay bright), active display area (that part of the screen that contains information), pixel resolution, and image sharpness. To illustrate, television sets have a bandwidth of about 4.5MHz, while computer monitor bandwidths range from 10MHz to more than 40MHz.

As with screen pixels and characters per screen, the higher the bandwidth number the better the image. A 4.5MHz bandwidth is readable

when using 40-column text or just graphics. Beyond a 40-column format, however, the characters become difficult to read.

Dot Pitch. Dot pitch is the distance between the holes in monitor's shadow mask, i.e., the distance between pixels. Dot pitch is measured in millimeters. A smaller dot pitch produces sharper characters and images. High-resolution monitors have a dot pitch of .31mm or less. A monitor with a dot pitch of more than .45mm is good enough for graphics but may not be appropriate for word processing.

Buying a monitor with a very small dot pitch does not guarantee that your microcomputer will produce high-quality images. Make sure you know your microcomputer's capabilities. In most cases, a monitor of .31mm dot pitch requires an extend-graphics adapter (EGA) to handle the monitor. The standard video card that may have come with your computer is not capable of taking advantage of monitors with a dot pitch below .41mm. If you purchased an EGA monitor recently, however, it may include an EGA card.

Convergence. Convergence is the accuracy with which a monitor's electron guns hit pixels. If they do not hit the pixels correctly, the characters and images become fuzzy, especially at the screen edges, and the colors get out of alignment. This feature is not usually included on specification lists because it is hard to measure. If the monitor has low convergence, you can see the effect on the screen.

Phosphor Persistence. Phosphor persistence is the amount of time a pixel remains visibly lit after being hit by an electron beam. Although monitors with long persistence are flicker-free, very long

persistence may be inadequate for programs requiring fast image change, such as animation graphics. Because it is still unclear what rate of phosphor persistence is best, this feature is not usually listed in monitor specifications.

Screen Coating. Some monitors offer many good features but their display areas are hard to read because they reflect light. Monitors coated with nonglare materials are available, for example, the Amdek 300 and 300A. If you purchase a monitor that is not glare-free, you can buy a screen to place over it. These screens cost between $10 and $35 and do the job very well.

Do not pay a lot for a monitor simply because it is made by a well-known company; you can save a lot of money by shopping around. There are excellent monitors made in Taiwan that are competitively priced. What determines a monitor's quality are the features discussed above.

Printer Selection

The major types of printers are dot matrix, daisy wheel, thimble, thermal, ink jet, and laser. These names reflect either the technology used to make them or the type of character they produce. Their features will be discussed below.

The list of printer types will grow as technology develops, and better design methods and cheaper components will keep costs low. For example, a daisy-wheel printer that cost more than $1000 a couple years ago costs less than $500 today.

What should you look for when shopping for a printer? As in microcomputer selection, first you should assess your needs. Next, consider the following printer features:

- quality of characters
- print pitch
- proportional spacing
- carriage width
- speed
- buffer
- support
- cost

Quality of Characters. The quality of characters produced by a printer depends on the character-formation process. Letter-quality printers use a "hammer," a device that strikes a carbon or fabric ribbon and impresses a character on the paper. In contrast, the much faster dot-matrix printers have a print head that contains tiny wires arranged in one or more columns called a matrix. Characters are produced by these tiny wires firing one at time; denser wires produce more legible characters.

Printer specifications include the print head's matrix. A 9x9 printer produces better characters than a 5x7 printer. In short, the larger the matrix, the better the characters produced. But note that a 9x9 matrix printer's characters are not near letter quality. To avoid disappointment, ask your vendor to show you samples of printers' standard print quality.

Thermal printers use a heat process to print high-quality text, but it tends to fade with time. These printers are no longer as popular as either dot-matrix or daisy-wheel printers.

Ink-jet printers "throw" ink on paper to produce high-quality text, but they are more expensive than dot-matrix and daisy-wheel printers. Ink-jet printers are especially good for graphics.

Daisy-wheel and thimble printers are letter-quality machines. Their drawback compared to dot-matrix printers is that they are slower and more expensive.

A new feature called NLQ (near letter quality) enables the user to push a combination of buttons on the printer to access a specific printing mode, such as compressed text and boldfaced text as well as near letter-quality text. Not all printers have NLQ, so ask your vendor about it.

Lastly, laser printers produce characters by using laser technology. They are available for less than $2000 and will become less expensive in the future.

Print Pitch. Pitch refers to characters' horizontal density or width. Dot-matrix printers normally print at 10 pitch, 12 pitch, 15 pitch, or 17 pitch.

Proportional Spacing. This feature prints characters according to the amount of space they take up. For example, in proportional spacing the letter W takes up more space than the letter I. Proportional spacing is most common in letter-quality printers, but some dot-matrix printers also have this feature.

Carriage Width. The carriage width determines the number of characters that can fit on a printed line. The most common carriage widths range between 8 inches and 15 inches. The wider the carriage width the more characters that will fit on a line. Of course, the number of characters per line also depends on the pitch and the print mode. The compressed mode, for example, squeezes in more characters per inch.

Speed. Dot-matrix, ink-jet, and laser printers print faster than daisy-wheel and thimble printers. While the new breed of printers, 24-pin machines, produce near letter-quality print, they do so at a considerably slower speed. Some dot-matrix printers are advertised as being capable of printing 200 or more characters per second, but they do so in draft mode. In letter-quality mode, their speed drops dramatically.

Laser printers are by far the fastest. Their manufacturers tend to round the number of pages the printers are capable of producing, and tests show that some printers reported to print 10 pages a minute actually print between eight and 10 pages. Unlike dot-matrix and letter-quality printers, a laser printer may take one minute to more than 10 minutes from the time you give the print command until a page is printed. In addition, if a document has graphics, you can expect a longer delay before the printed document appears.

Buffer. Many printers have a buffer, or printer memory, in which information can be stored to free the microcomputer to do other work as the printer prints. If the printer does not have a buffer, the microcomputer must wait until all the information is sent to printer

and printed before it can do anything else. This is a waste of microcomputer resources. Printer buffers can be added to many computers as an internal or external device.

If you have an Apple II series microcomputer, you can purchase a printer-interface card with a buffer. A well-known brand is Buffer-board by Orange Micro, Inc., which serves both as the printer interface and a buffer. This internal buffer is much cheaper than an external one. Another advantage of an internal buffer is that you can inexpensively increase the buffer capacity to suit your needs by adding more chips to the board.

Support. Printers, unlike microcomputers, have many mechanical parts and are more susceptible to damage. Plastic daisy wheels and thimbles are breakable. Metal daisy wheels are no less prone to breakage than plastic ones. Because printers have a tendency to break down, it is important to consider what support is available for your printer before you buy it.

Cost. Cost should be the last thing you consider when buying a printer. Do not buy a printer simply because it is cheap; you may be disappointed. You can now get a good letter-quality printer, especially a daisy-wheel type, for $300 or less but you must shop around. Do not purchase a printer for its brand name only. Printers produced by lesser-known manufacturers often are far better than those produced by the big names. But, again, do not underestimate the importance of support.

Conclusion

Today we are experiencing the fastest-changing technological developments ever, the microcomputer revolution. It is no longer possible to keep abreast of new technology. Before we understand how a product works, a more advanced model is introduced.

When selecting a microcomputer product, it is as important to define your needs precisely as it is to know about available options and support. In this way, you will get the best buy for your money.

GLOSSARY

add-on capability: a microcomputer design that allows for chips or cards to be installed later if one chooses to upgrade the microcomputer.

AT: acronym for Advanced Technology microcomputer, which is the post-PC (8088-based microprocessor) generation of microcomputers. The more powerful AT-type machines have an 80286 or 80386 microprocessor.

bandwidth: measured in megahertz, bandwidth is the speed at which a monitor can accept data from a microcomputer. The higher the bandwidth MHz, the better the monitor's performance will be in such areas as image sharpness.

convergence: refers to how accurately a monitor's electron guns hit pixels. Poor convergence causes monitor images to appear fuzzy and colors to be out of alignment.

DOS: acronym for Disk Operating System, which is the program that enables a microcomputer system to access disk drives and other peripheral devices.

EGA: acronym for Extended Graphics Adapter, which is a video-display card that can be added to a microcomputer to produce high-quality graphics images on a monitor.

letter quality: typewriter-quality text produced by a printer.

MHz: a unit of measurement that equals one million cycles per second.

modem: acronym for MOdulator-DEModulator; a modem converts microcomputer information so that it can be sent over telephone wires.

pixel: contraction of PICtureS ELement. Pixels are points of light on a monitor screen that make up displayed information such as text. Monitor clarity is commonly measured in pixels.

port: a microcomputer's external connecting points into which other devices, such as a modem or printer, may be plugged.

RAM: acronym for Random Access Memory, a microcomputer's information-storage area. The greater the RAM, the more information a microcomputer can process.

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